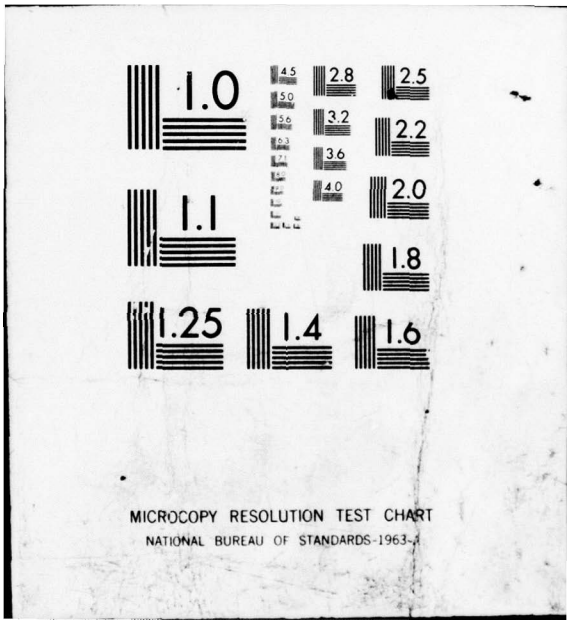
AD-A054 592 AIR FORCE PACKAGING EVALUATION AGENCY WRIGHT-PATTERSO--ETC F/G 13/4
PERFORMANCE ANALYSIS OF REDESIGNED PACKAGING SYSTEM FOR THE C-5--ETC(U)
FEB 78 F C JARVIS

UNCLASSIFIED PTPT-78-5 NL

| OF |
AD
A054592

END
DATE
FILMED
6-78
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FOR FURTHER TRANSMITTAL

PTPT REPORT NO. 78-5
AFPEA PROJECT NO. 77-P7-47

(12) cont

(14) PTPT-78-5

(10) FRANK C. JARVIS
Mechanical Engineering Technician

Autovon 787-7445
Commercial (513) 257-7445

(6) PERFORMANCE ANALYSIS OF REDESIGNED PACKAGING SYSTEM FOR THE C-5 INERTIAL MEASUREMENT UNIT.

HQ AFALD/PTP
AIR FORCE PACKAGING EVALUATION AGENCY
Wright-Patterson AFB OH 45433

(11) February 1978

(12) 12 p.

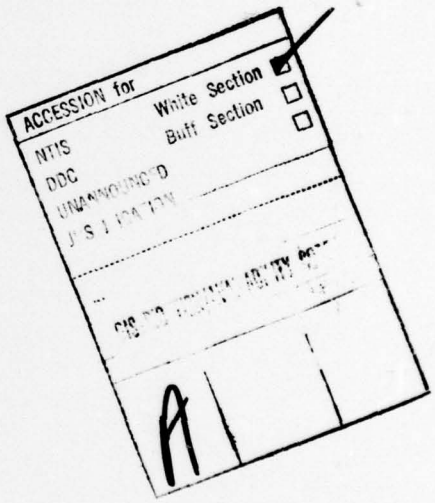
403 519

JOB

NOTICE

ABSTRACT

In cooperation with the Aerospace Guidance and Metrology Center (AGMC), Newark AFS, Ohio, the Air Force Packaging Evaluation Agency (AFPEA), Wright-Patterson AFB, Ohio, designed, developed and tested a prototype reusable shipping container and cushion insert for the C-5 Inertial Measurement Unit (IMU). This program resulted in AGMC awarding a contract for fabrication of 60 of the new pack designs to replace the currently used wood container pack. As specified in the contract, the contractor provided AFPEA with a completed pack for verification testing prior to the fabrication and delivery of the 60 units.



PREPARED BY: Frank C. Jarvis

FRANK C. JARVIS, Mechanical Engineering Technician, Materials Engineering Div., AF Packaging Evaluation Agency

PUBLICATION DATE:

10 MAR 1978

REVIEWED BY: Matthew A. Venetos

MATTHEW A. VENETOS
Chief, Materials Engineering Division
Air Force Packaging Evaluation Agency

APPROVED BY: Jack E. Thompson

JACK E. THOMPSON
Director, Air Force Packaging Evaluation Agency

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

INTRODUCTION

The purpose of this evaluation was to prevent the possibility of an unsatisfactory packaging system from entering the Air Force inventory as a result of non-adherence to contractual specifications or misinterpretation of the specifications and drawings. A problem with this particular pack design occurred because the drawing was difficult to interpret and the test pack was not fabricated as specified. This resulted in the contractor using 90% more cushioning material than was required and would have prevented proper protection for the IMU. Tests could not be conducted on the cushion configuration as received from the contractor because the IMU shell could not be inserted into the cavity. However, refitting of the cushioning insert resulted in an acceptable pack for verification testing.

DESCRIPTION OF TEST PACK

Shipping Container: This container was vacuum formed from rigid (white) polyethylene and includes corrosion resistant hardware. It is a standard size reusable container manufactured by Thermodyne International Ltd. (part no. 102557, type ATA-300). The nominal dimensions are 28" x 25" x 28" (Figure 1).

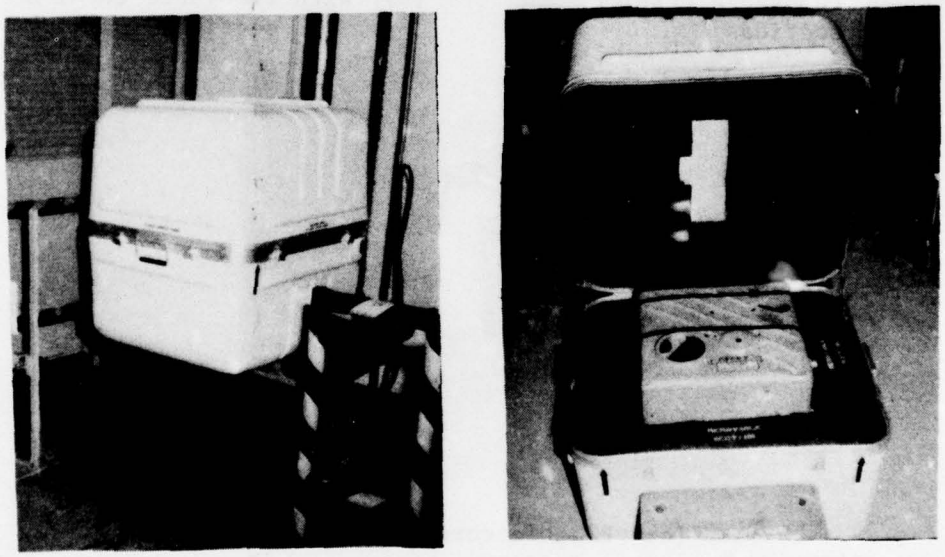
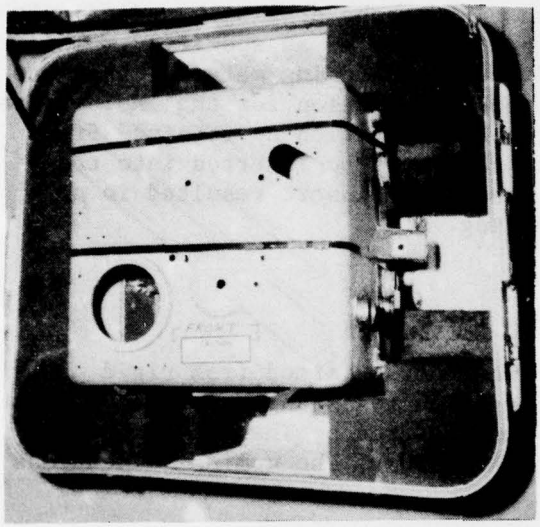
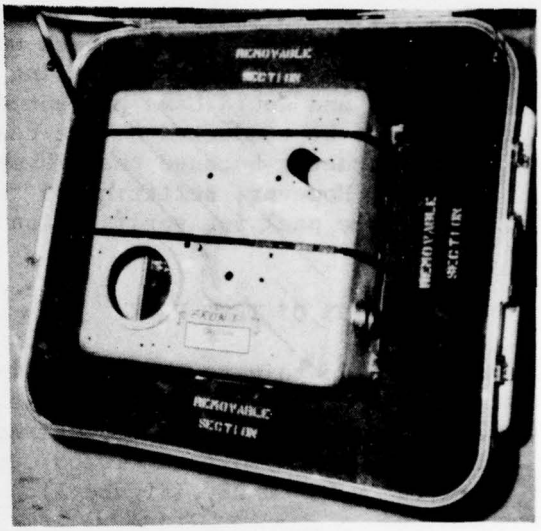


Figure 1. Test Pack

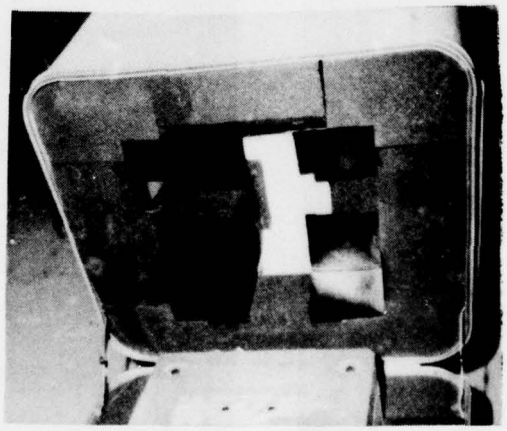
Cushion Insert: The cushioning material used is 4-pound polyurethane foam (ester base) bonded to the inner surfaces of the container with the exception of three removable cushion sections which allow for insertion of the IMU in the bottom cavity (Figures 2a and 2b). Plastic load distributors (corner plates) are bonded to the eight corner cushions to insure an equal weight distribution on the bearing surfaces and to prevent the IMU from tilting within the cavity walls (Figure 2c). The weight of the test pack is 51 pounds and the IMU is 85 pounds (gross weight 136 lbs).



(a) Without removable cushion sections



(b) With removable cushion sections



(c) Plastic corner plates

Figure 2.

TEST EQUIPMENT AND INSTRUMENTATION (Figure 3)

The following equipment and instrumentation was used to evaluate the test pack:

1. Gaynes Drop Tester
2. Oscilloscope, Tektronex 4 channel, Model 564B
3. Accelerometers, Tri-axial, Endevco Model 2233E
4. Power Supply, Endevco Model 2622C
5. Amplifier, Endevco Model 2614C

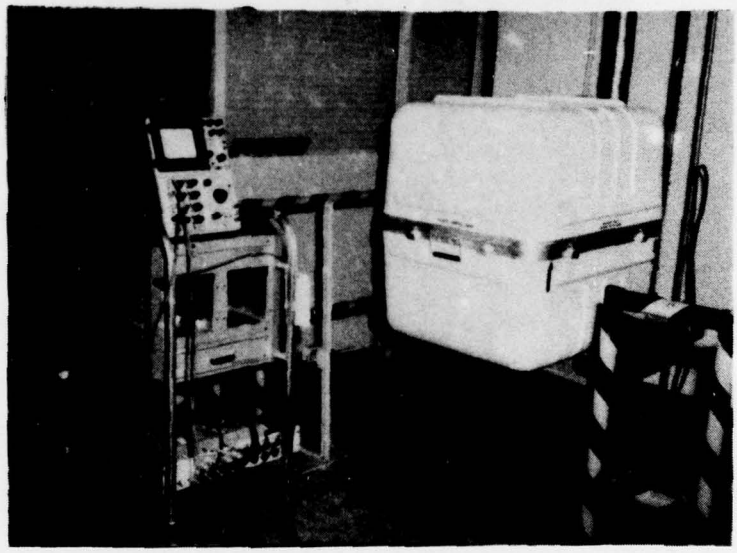


Figure 3. Test Apparatus

TEST PROCEDURE

Prior to conducting the drop tests on the pack provided by the contractor, the cushion insert was removed from the top and bottom sections of the container, the bonded joints were separated and the insert cut to the dimensions prescribed in the contract drawing. The modified sections were then re-bonded to the container walls. The scrap material resulting from this operation is shown in Figure 4.

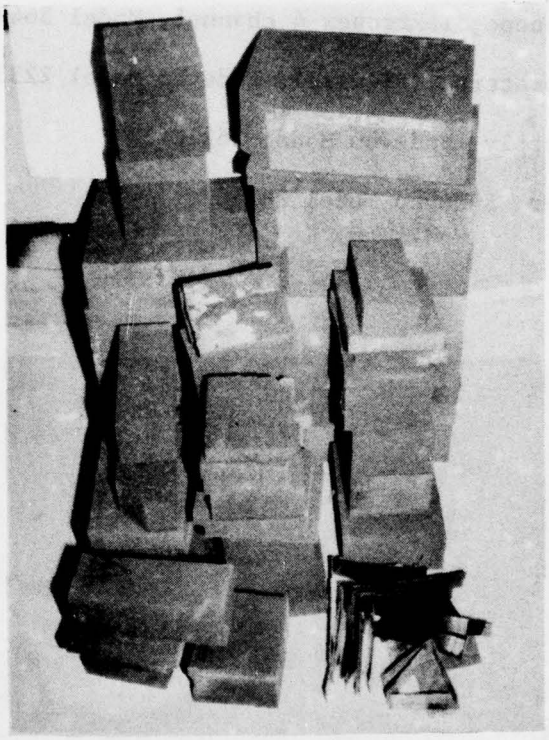


Figure 4. Scrap Material

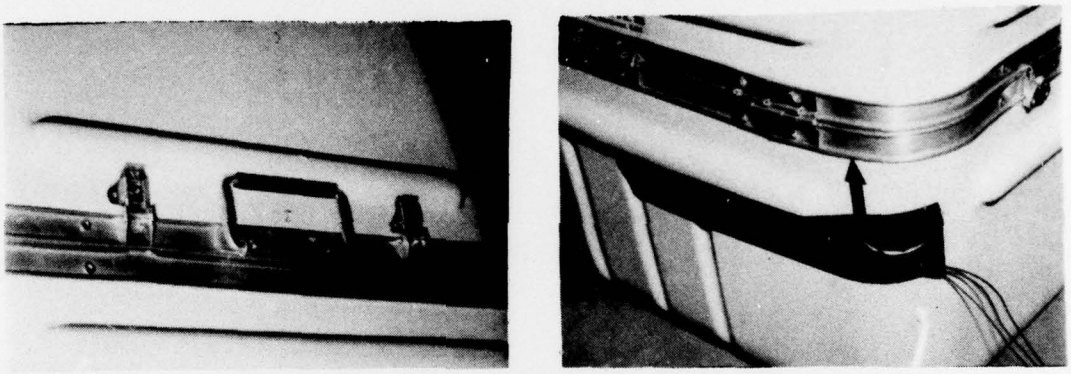
The free fall drop testing was conducted in accordance with Method 5007 of the Federal Test Method Standard 101B. The container was instrumented with a simulated 85 pound IMU and subjected to 6 flat face, 3 edge and 1 corner drops from a height of 21 inches. A tri-axial

accelerometer was located at the center of gravity of the test load. The results were displayed on the oscilloscope screen.

RESULTS

The average resultant force of the 10 drops produced a shock level of 15.0 Gs. The bottom face received a resultant force of 14.1 Gs. Since the item fragility is 15 Gs, this container should protect the IMU from a drop height up to 21 inches.

Minor damage occurred during these rough handling tests. The corner drop caused a slight indentation of the polyethylene container and the 4-6 (faces 4 & 6) edge drop caused damage to the right front and right side fasteners, allowing the container to be partially open (Figure 5a). During this series of drops, the container hinge was bent as shown in Figure 5b.



(a) Damaged Fastener (b) Damaged Hinge

Figure 5.

This damage was considered to be minor because the parts could be straightened with standard hand tools.

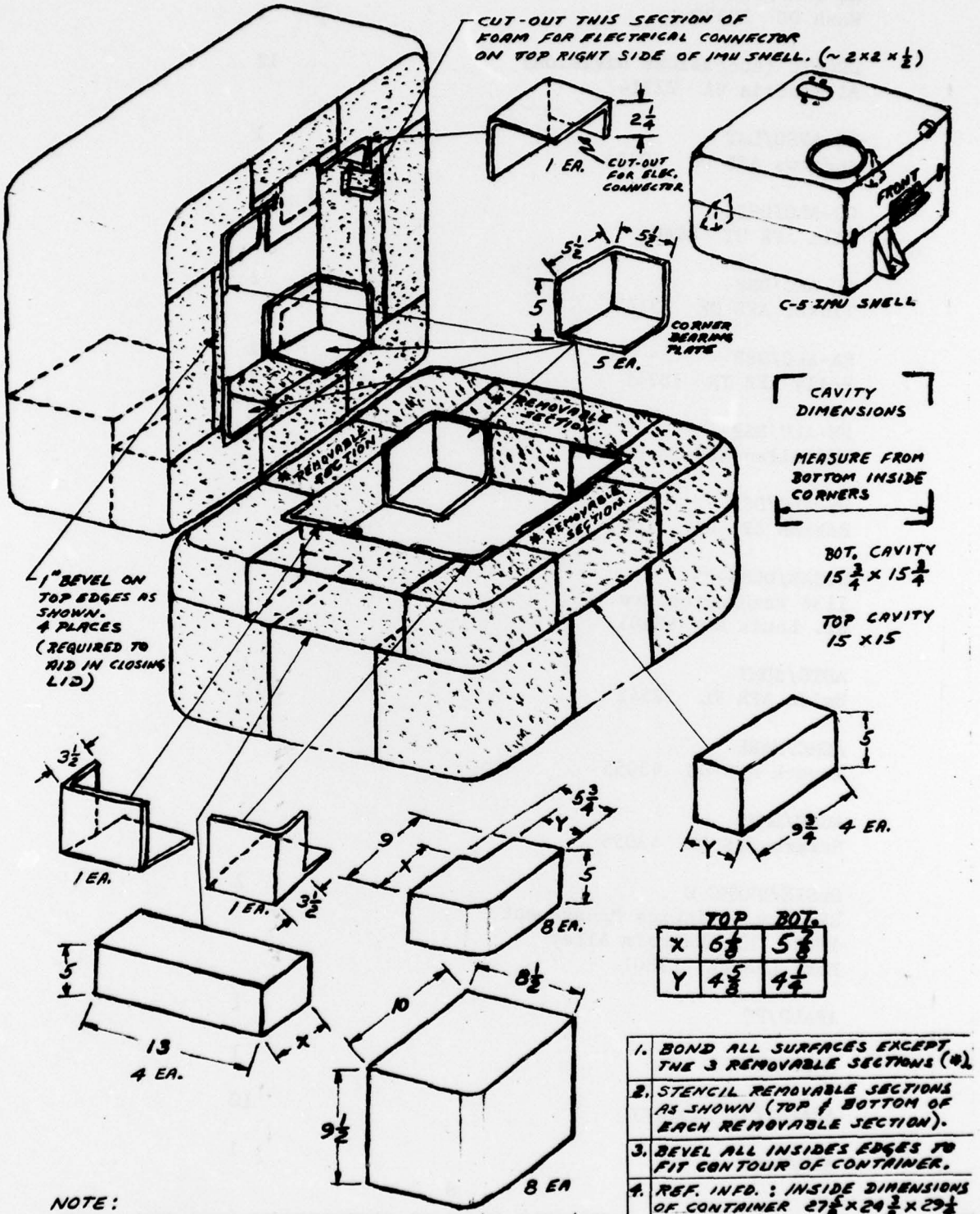
DISCUSSION

In addition to the drop tests, the cushioning material characteristics were evaluated and found to be acceptable as per MIL-26514D. The polyurethane was analyzed and verified by the Air Force Material Laboratory (AFML) to be an ester base as required in the contract.

After the completion of the tests, the modified pack was returned to the contractor to be used for reference during the fabrication of the 60 required units.

IMPLEMENTING ACTIONS

After the completion of this evaluation, the AGMC procurement office at Newark AFS was notified of the test results and copies of the revised drawing (Attachment 1) were provided for distribution to the contractor.



	TOP	BOT.
X	6 7/8	5 7/8
Y	4 5/8	4 1/4

1.	BOND ALL SURFACES EXCEPT THE 3 REMOVABLE SECTIONS (#).
2.	STENCIL REMOVABLE SECTIONS AS SHOWN (TOP & BOTTOM OF EACH REMOVABLE SECTION).
3.	BEVEL ALL INSIDES EDGES TO FIT CONTOUR OF CONTAINER.
4.	REF. INFO.: INSIDE DIMENSIONS OF CONTAINER 27 5/8 x 24 3/8 x 29 1/4
	12/2/77 Atch 1

NOTE:
THIS DRAWING SUPERSEDES ORIGINAL DRAWING ATCH. 1 OF CONTRACT IFB F33659-77 B0018

DISTRIBUTION LIST

HQ USAF/LGTN Wash DC 20330	1
DDC-TC (Accessions Division) Alexandria VA 22314	12
HQ AFSC/LGT Andrews AFB DC 20334	1
OO-ALC/DSTC Hill AFB UT 84406	6
OC-ALC/DSP Tinker AFB OK 73145	2
SA-ALC/DSP Kelly AFB TX 78241	2
SM-ALC/DSP McClellan AFB CA 95652	2
WR-ALC/DSP Robins AFB GA 31098	2
DCSAR/DCRS-PS 1136 Washington Ave. St. Louis MO 63101	3
ADTC/SDMT Eglin AFB FL 32542	1
AGMC/MABE Newark AFS OH 43055	2
AGMC/DMTP Newark AFS OH 43055	1
DLSIE/DRXMC-D US Army Logistics Management ATTN: Mr. Malcolm Alley Fort Lee VA 23801	2
AFALD/PT	1
AFLC/LOT	1
AFALD/PTP Library	10
ASD/AEGT	1

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: PTPT Report No. 78-5	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): PERFORMANCE ANALYSIS OF REDESIGNED PACKAGING SYSTEM FOR THE C-5 INERTIAL MEASUREMENT UNIT	5. TYPE OF REPORT & PERIOD COVERED
	6. PERFORMING ORG. REPORT NUMBER: AFPEA Project No. 77-P7-47
7. AUTHOR(s): Frank C. Jarvis	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: AFALD/PTPT, Wright-Patterson AFB OH 45433	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: AFALD/PTP, Wright-Patterson AFB OH 45433	12. REPORT DATE: February 1978
	13. NUMBER OF PAGES: 12
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

C-5 IMU container, plastic prototype, cushion inserts, performance data.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

In cooperation with the Aerospace Guidance and Metrology Center (AGMC), Newark AFS, Ohio, the Air Force Packaging Evaluation Agency (AFPEA), Wright-Patterson AFB OH, designed, developed and tested a prototype reusable shipping container and cushion insert for the C-5 Inertial Measurement Unit (IMU). This program resulted in AGMC awarding a contract for fabrication of 60 of the new pack designs to replace the currently used wood container pack. As specified in the contract, the contractor provided AFPEA with a completed pack for verification testing prior to the fabrication and delivery of the 60 units.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)